A comparison of 2 different suture patterns for skin closure of canine ovariohysterectomy

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Abstract — The purpose of this study was to compare postoperative wound healing in canine ovariohysterectomy following the use of an absorbable monofilament poliglecaprone 25 suture in 2 different skin closure techniques, the buried continuous subcuticular (BCS) suture pattern and the simple interrupted (SI) suture pattern. These 2 skin closure techniques were evaluated against a nonabsorbable polypropylene monofilament suture in an SI pattern. Wounds were assessed by using a semiquantitative scoring system at 18 to 24 hours and 10 to 14 days, postoperatively. Results indicated that the BCS closure using poliglecaprone 25 demonstrated a higher rate of tissue reactivity initially (18–24 hours postoperatively), as compared with the SI closure using either suture material. By 10 to 14 days postoperatively, poliglecaprone 25 used in a BCS closure was associated with significantly lower wound scores than was the same material used in an SI closure. It was concluded that the BCS closure may effect a better cosmetic appearance to the skin closure in a canine ovariohysterectomy at the time of the recheck appointment. Furthermore, by obviating the need for suture removal, use of the BCS pattern may eliminate the requirement for this return appointment.

Résumé — Comparaison de 2 types de sutures pour la fermeture de la peau lors d'ovario-hystérectomie chez la chienne. Le but de cette étude était de comparer la guérison post-chirurgicale d'une plaie d'ovario-hystérectomie chez la chienne suite à l'utilisation d'un fil en monofilament absorbable de poliglecaprone 25 dans 2 techniques différentes de fermature de la peau, le point continu intradermique (CID) et le point simple discontinu (SD). Ces 2 techniques de fermature de la peau ont été évaluées en comparaison avec un fil non absorbable en monofilament de polypropylène. Les plaies ont été évaluées par utilisation d'un système semi-quantitatif de cotation aux heures 18 à 24 et aux jours 10 à 14 après l'opération. Les résultats indiquent que la suture CID de poliglecaprone 25 montre un plus haut taux initial de réactivité tissulaire (18–24 heures après l'opération) comparé à la fermeture avec un ou l'autre des matériaux. Aux jours 10 à 14 suivants l'opération, le poliglecaprone 25 utilisé en technique CID était associé à des cotes de plaies significativement plus basses que celles associées à la fermeture SD avec le même matériel. Il a été conclu que la fermeture CID peut donner à la peau une plus belle apparence cosmétique lors d'ovario-hystérectomie chez la chienne au moment du rendez-vous de contrôle. De plus, en prévenant le besoin d'enlever les sutures, l'utilisation de la techniue CID pourrait éliminer le besoin de ce rendez-vous de contrôle.

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Introduction

The buried continuous subcuticular (BCS) suture pattern has been used in veterinary medicine as an alternative to simple interrupted (SI) suture pattern for skin closure. It was developed as a way of reducing wound infection by avoiding percutaneous suture tracts (1). The BCS closure has many advantages in elective surgeries, such as eliminating the need for suture removal, causing less pain, and reducing any visible scarring (1,2). The risk of self-induced trauma is also reduced, since there is no protruding material for the patient to lick or scratch. It apposes skin edges evenly, which promotes rapid epithelialization (3). This closure pattern, however, requires substantial implanted suture, as well as increased tissue handling (1).

The choice of suture material also impacts on wound healing (4). Poliglecaprone 25 (Monocryl; Ethicon, Markham, Ontario), a synthetic absorbable monofilament suture, has the advantages of superlative strength, and pliability, being noncapillary and inert, and possessing a low coefficient of friction (5). In addition, tissue drag during passage of the suture through skin was shown to be significantly less than that with chromic gut suture of similar size (5).

The objective of the study was to compare the frequency of wound complications in dogs undergoing ovariohysterectomy (OVH) with the skin closed with the BCS pattern, using poliglecaprone 25 suture, with that

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in dogs with the skin closed with the SI pattern, using poliglecaprone 25 or polypropylene suture.

Materials and methods

Case selection

The study was performed using 120 client-owned dogs at 4 veterinary practices in southern Ontario, each with 1 surgeon assigned to the study. At each practice, 30 dogs were selected for the study from the population that was being presented for elective OVH; each dog was less than 1 y old, had not received antibiotic or antiinflammatory drugs in the past 7 d, and was free of skin disease. In addition, all owners were required to give informed consent prior to their dog being enrolled in the study.

Experimental protocol

Preinduction medication was administered and anesthesia was induced with either thiopental or a combination of ketamine and diazepam. A surgical plane of anesthesia was maintained by using isoflurane (Aerrane; Janssen, Toronto, Ontario). The surgical site was clipped with a #40 clipper blade. Surgical preparation of the skin was in 3 stages: 4% chlorhexidine gluconate soap (Hibitane; Ayerst, Saint Laurent, Quebec), followed by isopropyl (70%) alcohol, and then chlorhexidine gluconate (Savlon; Ayerst), 1:30 diluted with isopropyl alcohol (70%).

Ovariohysterectomy was performed through a ventral midline skin incision, between 2.5 and 5 cm long, using standard procedure (6). The ligatory suture material used for ovarian and uterine pedicles was 2-0 or 3-0 poliglecaprone 25. The surgical site was closed in the following manner: the linea alba was sutured in a SI pattern using 2-0 or 3-0 poliglecaprone 25, the subcutaneous layer was closed with a simple continuous pattern using 3-0 poliglecaprone 25. Knots were tied with 4 single throws for the interrupted pattern and 5 throws for the continuous pattern.

All dogs were treated with meloxicam (Metacam; Boehringer Ingelheim Vetmedica, Burlington, Ontario), 0.2 mg/kg body weight (BW), SC, for postoperative analgesia once they were judged to be normotensive.

Skin closure

All investigators used Olsen-Hegar needle holders (Codman; Johnson & Johnson Professional, Markham, Ontario) and Adson tissue forceps (Codman; Johnson & Johnson Professional) for skin closure. Dogs were randomly assigned via a computer generated random number table to 1 of 3 groups to determine the skin closure technique. Group 1 dogs received a BCS closure with 3-0 poliglecaprone 25 suture on a reverse cutting needle (Ethicon code Y923H; Ethicon). Group 2 received an SI closure with 3-0 poliglecaprone 25 suture on a reverse cutting needle (Ethicon codeY923H; Ethicon). Group 3 received an SI closure with 3-0 polypropylene suture on a reverse cutting needle (Prolene, Ethicon code 8665H; Ethicon). All sutures in the SI closures were placed 8 mm apart.

Wound scoring

The clinical appearance of the skin was scored at 2 time points: 18 to 24 h and 10 to 14 d postsurgery. The skin incisions were scored by 1 person per clinic, either another surgeon or a trained individual, based on the following criteria: swelling, erythema, dehiscence, and discharge (Table 1). This scoring system was adapted from a previously published protocol (1).

Table 1. Criteria used to score appearance of wounds

	Score			
Outcome	0	1	2	3
Swelling (mm) (Wound edges thicker than surrounding skin)	None	0–2 mm	2–5 mm	> 5 mm
Erythema (mm) Distance from wound margin	None	0–2 mm	2–5 mm	> 5 mm
Dehiscence % of suture line	None	0–20%	20%–50%	> 50%
Discharge	None	Serosanguinous	Purulent	

Table 2. Assessment of different variables within the 3 closure techniques

Variables	Group 1	Group 2	Group 3
Age (d)	212	203	195
Weight (kg)	13.6	12.4	15.1
Incision length (mm)	32	33	34
Time to recheck (d)	12.0	11.9	11.3

There were no statistically significant differences between treatments for any of the variables listed ($P < 0.05$)

Statistical methods

The total wound score at 10 to 14 d postoperatively was the primary outcome variable. Differences between treatments were tested by using analysis of variance in a randomized complete block design, using surgeons as blocks, at a 5% level of significance. Frequency distributions of the residuals from each model, as well as plots of the residuals by predicted value and treatment, were prepared and examined for normality and homogeneity of variance. An appropriate sample size for this study was estimated by using standard sample size formula for comparing the means of 2 treatments where the outcome is continuous (7).

Results

Each investigator enrolled 30 dogs in the study for a total of 120. Each treatment group consisted of 40 dogs. All 3 treatment groups were similar with regard to breed, age, weight of dog, and the length of the surgical incision (Table 2).

At 18 to 24 h postoperatively, the skin wounds in Group 1 (poliglecaprone 25, BCS) demonstrated more complications than did those in Group 2 (poliglecaprone 25, SI) and Group 3 (polypropylene, SI) (Figure 1). There were no differences between Groups 2 and 3 at this stage. By 10 to 14 d postoperatively, dogs on which a BCS pattern had been used showed significantly fewer wound complications than did those where an SI pattern had been used with the same suture

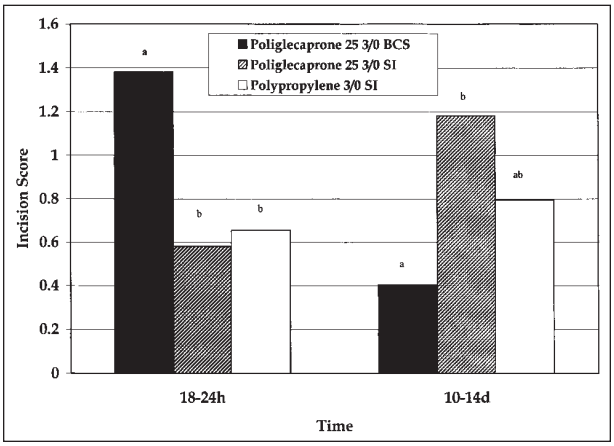

Figure 1. Effect of different materials and suture patterns on incision score following canine ovariohysterectomy.
[ab]Means within each time period having differing superscripts are significantly different ($P < 0.05$).

Table 3. Mean score of swelling, erythema, dehiscence and discharge for different closure techniques at times 18 to 24 h, and 10 to 14 d after surgery

	Total scores		
Outcome	Group 1	Group 2	Group 3
18 to 24 h			
Swelling	0.50[a]	0.28[b]	0.23[b]
Erythema	0.88[a]	0.30[b]	0.43[b]
Dehiscence	0.00[a]	0.00[a]	0.00[a]
Discharge	0.00[a]	0.00[a]	0.00[a]
Composite	1.38[a]	0.58[b]	0.66[b]
10 to 14 d			
Swelling	0.30[a]	0.42[a]	0.36[a]
Erythema	0.11[a]	0.64[b]	0.44[b]
Dehiscence	0.00[a]	0.00[a]	0.00[a]
Discharge	0.00[a]	0.12[b]	0.00[a]
Composite	0.41[a]	1.18[b]	0.79[ab]

[ab]Means within a row having differing superscripts are significantly different ($P < 0.05$)

material. Specifically, the BCS closures initially demonstrated more swelling and erythema than did the SI closures. This swelling and erythema resolved by 10 to 14 d postoperatively. Furthermore, at this time, the dogs in the SI groups demonstrated more erythema than did those in the BCS group; the SI group in which poliglecaprone 25 was used (Group 2) also demonstrated more discharge (Table 3). There were no instances of dehiscence for any dog in the study.

However, the use of polypropylene as opposed to poliglecaprone 25 for the SI closure technique had no significant effect on the level of complications at either time period (Figure 1).

Discussion

In this study, the increased swelling and erythema noted in the first 18 to 24 h following the use of the BCS technique may have been due to the greater tissue handling required for suture placement, as well as the increase in the amount of implanted suture. Implanted suture is identified by the immune system as foreign material, and the inflammatory response is described as a foreign body reaction (8). This response is crucial for normal wound healing to occur. In a previous study on cats, there was increased incisional swelling 24 h postoperatively when an SC suture layer was added (9). Swelling did not appear to be associated with any one type of suture.

Suture materials affect healing through their interaction with tissue. The diameter and length of suture, its physical construction, and its chemical composition will influence healing (4). The severity of a reaction is influenced by the amount of suture material in situ and the degree of tissue trauma produced by the surgical procedure (8). The use of poliglecaprone 25 with a swaged reverse cutting needle minimizes tissue trauma, maintains needle strength, and decreases the risk of suture pull out, as compared with eyed needles (4). Furthermore, poliglecaprone 25 is one of the strongest absorbable sutures available: the tensile strength for size 2-0 poliglecaprone 25 suture has been measured as 16.14 lbs compared with polyglactin 910 (Vicryl; Ethicon) (15.28 lbs), and *p*-dioxanone homopolymer (PDSII; Ethicon) (10.77 lbs) (5).

Other studies have reported the frequencies of complications in elective OVH in dogs as ranging from 1%to 24% (10,11). There are many risk factors for the development of postoperative wound complications in veterinary medicine. Proper aseptic technique, hypothermia, duration of anesthesia, and the degree of postoperative care, have all been demonstrated to affect healing (12). Postoperative meloxicam treatment may also have contributed to the overall low composite scores for wound complications reported here. In addition to relieving pain, it may have benefited all groups by limiting postoperative swelling, discomfort, and self-trauma.

The poliglecaprone 25 suture that was used appeared to be an excellent choice for BCS closure (3). Due to its superior tensile strength, low coefficient of friction, and low reactivity, it provided good support during the critical wound healing period. Since the same poliglecaprone 25 suture was also used for ligation of vessels and the uterine stump, being able to employ only 1 suture packet for an entire procedure is an added benefit of this technique, as it reduces costs and limits waste. A common practice has been to use chromic gut suture on a cassette for ligatures and polyamide cassette suture for skin closure. The disadvantages of this practice include less reliable sterility and increased tissue trauma associated with greater tissue drag. Chromic gut suture also has less tensile strength, provides poorer knot security, and is not absorbed as predictably as synthetic materials. Furthermore, these cassette sutures require an eyed needle for skin closure, which increases the tissue trauma as they are passed through the skin. Reused needles are never as sharp as are new swaged needles.

For practitioners unaccustomed to using synthetic monofilament sutures, it is important to note that an insecure knot will cause even an exceptionally reliable suture to fail. A study on knotting ability demonstrated that a 3-throw square knot was the minimum required for these sutures (13). In the present study, 4 throws (interrupted patterns) or 5 throws (continuous patterns) were used and no dehiscence was observed.

Consistent with other studies, the investigators commented that the BCS pattern was somewhat more technically demanding and time-consuming than was the SI pattern (1,2). Carefully placed final bites are required for correct apposition and complete knot burial. The BCS pattern can be more challenging in a thin dermis and requires more instrument handling of skin. Dermal separation or malapposition will slow epidermal bridging, resulting in second intention wound healing.

In this study, BCS closure provided a superior end result, with a lesser degree of complications. The initial inflammatory result did not impede the overall healing at 10 to 14 d. It is concluded that the BCS pattern is a useful technique for closure in the elective canine spay.

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